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RESULTS OF SEEDING GERMINATED WESTERN WHITE PINE SEED

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Seed-eating rodents have been a major cause of failure in many tests of direct seeding western white pine in the past. (3) Poisoning in advance of sowing or protecting seed spots with screens has successfully reduced damage by rodents, but these measures increase the cost of direct seeding. (4) Observations by Virgil D. Moss, Office of Blister Rust Control, Bureau of Entomology and Plant Quarantine, indicated a possibility that spring planting of germinated seed would eliminate the necessity for rodent control because preliminary evidence showed that rodents would not eat germinated seeds. (2) To determine the practicability of sowing germinated white pine seed as a method of direct seeding, the Northern Rocky Mountain Forest and Range Experiment Station began field tests in 1948. The present paper reports the results of these tests.

THE EXPERIMENT

The first of a series of plots was seeded in May 1948. The site chosen was a broadcast burned tract on Blickensderfer Creek, Kaniksu National Forest, Washington. Tests were repeated on the same area in 1949 and 1950. An additional plot was seeded in 1950 on Meadow Creek, Clearwater County, Idaho, on land owned by Potlatch Forests, Inc., that had been accidentally burned in 1949 after logging.

Many factors may limit the success and practicability of direct seeding, but only two of the more important were studied in the present tests. The factors studied were (1) advance preparation of seed (germinated versus non-germinated seed), and (2) protection from rodents (screened versus unscreened seed spots). The protected seed spots were covered by cone-shaped screens made from three-mesh

1/ Acknowledgement is made to Virgil D. Moss and Richard T. Bingham of the Office of Blister Rust Control, Bureau of Entomology and Plant Quarantine, for advice on techniques used in preparing and sowing the seed and for the use of their laboratory equipment; and to Lowell Adams, Biologist, U. S. Fish and Wildlife Service, for cooperation in measuring rodent damage and studying rodent populations as mentioned in the report.

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galvanized hardware cloth. On the Blickensderfer Creek plots the four combinations of seed preparation and protection against rodents were arranged in three subplots. Each subplot was halved into blocks and each block contained four sub-blocks of 25 seed spots each, one sub-block for each of the four seed preparation-protection combinations. Two subplots were located on a northeast-facing slope and one on a south-facing slope. The Meadow Creek plot was similar in arrangement except that only two subplots were seeded, one on a north-facing slope and one on a south-facing slope. Thus, in all, 2200 seed spots were employed in the test.

Delayed germination is characteristic of western white pine seed and special treatments often are considered to be necessary for satisfactory germination of spring-planted seed. (1) In the 1948 test, seed-coat cracking and stratification were used to induce prompt germination. The seeds to be germinated were processed in a machine designed to crack the seed coat without injuring the embryo. 2/ All the seeds were then stratified in moist sand at temperatures of 34 to 40 degrees Fahrenheit for periods of one to three months to overcome inherent dormancy. Seed-coat cracking was abandoned in the later tests because it was found to be unnecessary. In 1949 and 1950, the seeds were stratified in moist sand for three months to induce prompt germination. At the end of the stratification periods, half the seeds were exposed to room temperature until germination occurred. As soon as the radicles appeared through the seed coats, the seeds were returned to refrigeration to arrest further development until time for field planting.

The seeds were transported from the laboratory to the field planting site in sealed glass jars. Damp cheesecloth was added to keep the seeds moist.

Seed spots were prepared by scraping litter and duff from an area about 16 inches in diameter with a mattock or hazel hoe. The seeds were sown in mineral soil and covered with about three-eighths inch of mineral soil. Ten seeds per spot were sown on sub-blocks receiving germinated seeds, and twenty seeds per spot were sown on sub-blocks receiving ungerminated seed.

Spring-planted seed must be sown as early as possible to induce the deepest possible root penetration as protection against summer drought. All the plots in the present test except one were seeded as soon as the area was accessible in the spring. The 1949 seeding was delayed until June 15 because the germinated seeds were not ready for field planting until that time.

Knowledge of the rodent population was necessary to evaluate correctly the effect of protection against rodents. Lowell Adams, Biologist for the United States Fish and Wildlife Service, measured the rodent population on the Blickensderfer Creek area at the time of seeding in 1948 and 1949 and inspected all the unscreed spots for evidence of rodent molestation two days after the seeds were sown.

2/ The seed cracking machine was built by Richard T. Bingham, Division of Blister Rust Control, Bureau of Entomology and Plant Quarantine, and patterned after a laboratory seed sheller developed by Sallans and Sinclair (1945).

To follow the rate of stocking, observations were made two weeks, one month, and two months after seeding. At each observation the total number of seedlings on each spot was recorded. The proportion of spots on each sub-block that contained at least one established seedling was the measure of stocking used in the analysis.

Differences in stocking among sub-blocks were tested by the analysis of variance method to determine the effect of different treatments.

RESULTS

The experiment showed that sowing germinated seed did not eliminate the necessity for rodent control. The proportion of screened spots stocked with one or more seedlings two months after seeding was nearly seven times greater than of the unscreened spots (table 1). Since the increase in stocking due to screening was as great with germinated as with ungerminated seed, the use of germinated seed did not alter the beneficial effect of screening. Inspection of the seed spots two days after the seeds were sown showed that 80 and 96 percent of the unprotected spots were molested by rodents in 1948 and 1949 respectively. The large number of unscreened spots showing visible signs of molestation is further evidence that rodents were largely responsible for the poor stocking on unprotected spots.

In this experiment, no increase in stocking resulted from sowing germinated seed. Stocking varied considerably between plots and within plots, but the average stocking from germinated and ungerminated seed was practically the same.

Table 1.-- Proportion of seed spots containing one or more white pine seedlings two months after sowing with germinated and non-germinated seed. 1/

Plot location and year of sowing	Non-germinated seed		Germinated seed		All treatments
	Unscreened	Screened	Unscreened	Screened	
	Percent	Percent	Percent	Percent	Percent
Blickensderfer Creek					
1948	5	19	4	23	12.75
1949	4	33	6	52	23.75
1950	8	81	6	59	38.50
Meadow Creek					
1950	15	54	9	53	32.75
Average 2/	7.36	46.09	6.00	46.18	26.40

1/ Basis: percent values given for Blickensderfer Creek are each based on 150 seed spots; for Meadow Creek, 100 seed spots.
2/ Weighted average of eleven subplots.

DISCUSSION

Rodent population studies on the Blickensderfer Creek burn led to the conclusion that the rodent population was representative of this kind of habitat in the white pine type. Hence, the great amount of rodent damage to the unscreened spots was not the result of an abnormally large rodent population.

Several factors contributed to wide variation in stocking between years and subplots. Low viability of the seed lot in 1948 resulted in poor stocking on the whole plot. In 1949, when the seed was not sown until June 15, the soil on the south-facing subplot was dry and hot at the time of seeding. Only one seedling was counted on that subplot. As a result, even though stocking was good on the other subplots the average for the plot was poor. However, the importance of the results of this experiment lies in the differences between treatments rather than in the average stocking for a plot.

Spring planting in the northern Rocky Mountains has several disadvantages. The spring season is short; hence, the period suitable for seeding is shorter than in the fall. Mountain roads are often impassable in the early spring, making many areas inaccessible during the period best suited for direct seeding. Spring sown seed is also more susceptible to summer drought injury.

Sowing germinated seed helps overcome some of the usual disadvantages of spring seeding such as delayed germination and susceptibility to summer drought, but it introduces other difficulties. In the present tests, considerable mortality occurred in transporting the germinated seed from the laboratory to the planting site. When the transportation time totaled more than one day many of the emerged radicles were injured, apparently by heat.

SUMMARY

Present recommended methods of direct seeding western white pine call for planting in the fall following the control of seed-eating rodents by poisoning. Spring sowing germinated seed was tested on four plots as a method of eliminating direct rodent control in order to reduce the cost of direct seeding.

This test showed that initial stocking from spot sown germinated seed was no better than from seed that had been stratified but not germinated. On the other hand, protecting the seed spots from rodents with conical wire screens resulted in significantly greater initial stocking. Therefore, spring seeding germinated western white pine seed did not eliminate the necessity for rodent control in direct seeding.

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